SEQUENCE LISTING

<110> Mahanthappa, Nagesh K.

<120> NEUROPROTECTIVE METHODS AND REAGENTS

<130> ONV-043.02

<140> 09/418,221
<141> 1999-10-14

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<151> 1997-06-27

<160> 26

<170> PatentIn Ver. 2.0

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<220>
<221> CDS
<222> (1)..(1275)

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Met Val Glu Met Leu Leu Leu Thr Arg Ile Leu Leu Val Gly Phe Ile
  1               5                  10                  15

tgc gct ctt tta gtc tcc tct ggg ctg act tgt gga cca ggc agg ggc    96
Cys Ala Leu Leu Val Ser Ser Gly Leu Thr Cys Gly Pro Gly Arg Gly
              20                  25                  30

att gga aaa agg agg cac ccc aaa aag ctg acc ccg tta gcc tat aag   144
Ile Gly Lys Arg Arg His Pro Lys Lys Leu Thr Pro Leu Ala Tyr Lys
          35                  40                  45

cag ttt att ccc aat gtg gca gag aag acc cta ggg gcc agt gga aga   192
Gln Phe Ile Pro Asn Val Ala Glu Lys Thr Leu Gly Ala Ser Gly Arg
      50                  55                  60

tat gaa ggg aag atc aca aga aac tcc gag aga ttt aaa gaa cta acc   240
Tyr Glu Gly Lys Ile Thr Arg Asn Ser Glu Arg Phe Lys Glu Leu Thr
 65                  70                  75                  80

cca aat tac aac cct gac att att ttt aag gat gaa gag aac acg gga   288
Pro Asn Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Thr Gly
                  85                  90                  95

gct gac aga ctg atg act cag cgc tgc aag gac aag ctg aat gcc ctg   336
Ala Asp Arg Leu Met Thr Gln Arg Cys Lys Asp Lys Leu Asn Ala Leu
              100                 105                 110
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gcg atc tcg gtg atg aac cag tgg ccc ggg gtg aag ctg cgg gtg acc    384
Ala Ile Ser Val Met Asn Gln Trp Pro Gly Val Lys Leu Arg Val Thr
        115             120             125

gag ggc tgg gac gag gat ggc cat cac tcc gag gaa tcg ctg cac tac    432
Glu Gly Trp Asp Glu Asp Gly His His Ser Glu Glu Ser Leu His Tyr
        130             135             140

gag ggt cgc gcc gtg gac atc acc acg tcg gat cgg gac cgc agc aag    480
Glu Gly Arg Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Arg Ser Lys
145             150 .           155             160

tac gga atg ctg gcc cgc ctc gcc gtc gag gcc ggc ttc gac tgg gtc    528
Tyr Gly Met Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val
                165             170             175

tac tac gag tcc aag gcg cac atc cac tgc tcc gtc aaa gca gaa aac    576
Tyr Tyr Glu Ser Lys Ala His Ile His Cys Ser Val Lys Ala Glu Asn
            180             185             190

tca gtg gca gcg aaa tca gga ggc tgc ttc cct ggc tca gcc aca gtg    624
Ser Val Ala Ala Lys Ser Gly Gly Cys Phe Pro Gly Ser Ala Thr Val
            195             200             205

cac ctg gag cat gga ggc acc aag ctg gtg aag gac ctg agc cct ggg    672
His Leu Glu His Gly Gly Thr Lys Leu Val Lys Asp Leu Ser Pro Gly
        210             215             220

gac cgc gtg ctg gct gct gac gcg gac ggc cgg ctg ctc tac agt gac    720
Asp Arg Val Leu Ala Ala Asp Ala Asp Gly Arg Leu Leu Tyr Ser Asp
225             230             235             240

ttc ctc acc ttc ctc gac cgg atg gac agc tcc cga aag ctc ttc tac    768
Phe Leu Thr Phe Leu Asp Arg Met Asp Ser Ser Arg Lys Leu Phe Tyr
                245             250             255

gtc atc gag acg cgg cag ccc cgg gcc cgg ctg cta ctg acg gcg gcc    816
Val Ile Glu Thr Arg Gln Pro Arg Ala Arg Leu Leu Leu Thr Ala Ala
                260             265             270

cac ctg ctc ttt gtg gcc ccc cag cac aac cag tcg gag gcc aca ggg    864
His Leu Leu Phe Val Ala Pro Gln His Asn Gln Ser Glu Ala Thr Gly
            275             280             285

tcc acc agt ggc cag gcg ctc ttc gcc agc aac gtg aag cct ggc caa    912
Ser Thr Ser Gly Gln Ala Leu Phe Ala Ser Asn Val Lys Pro Gly Gln
            290             295             300

cgt gtc tat gtg ctg ggc gag ggc ggg cag cag ctg ctg ccg gcg tct    960
Arg Val Tyr Val Leu Gly Glu Gly Gly Gln Gln Leu Leu Pro Ala Ser
305             310             315             320

gtc cac agc gtc tca ttg cgg gag gag gcg tcc gga gcc tac gcc cca    1008
Val His Ser Val Ser Leu Arg Glu Glu Ala Ser Gly Ala Tyr Ala Pro
                325             330             335
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ctc acc gcc cag ggc acc atc ctc atc aac cgg gtg ttg gcc tcc tgc    1056
Leu Thr Ala Gln Gly Thr Ile Leu Ile Asn Arg Val Leu Ala Ser Cys
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tac gcc gtc atc gag gag cac agt tgg gcc cat tgg gcc ttc gca cca    1104
Tyr Ala Val Ile Glu Glu His Ser Trp Ala His Trp Ala Phe Ala Pro
            355             360             365

ttc cgc ttg gct cag ggg ctg ctg gcc gcc ctc tgc cca gat ggg gcc    1152
Phe Arg Leu Ala Gln Gly Leu Leu Ala Ala Leu Cys Pro Asp Gly Ala
            370             375             380

atc cct act gcc gcc acc acc acc act ggc atc cat tgg tac tca cgg    1200
Ile Pro Thr Ala Ala Thr Thr Thr Thr Gly Ile His Trp Tyr Ser Arg
385             390             395             400

ctc ctc tac cgc atc ggc agc tgg gtg ctg gat ggt gac gcg ctg cat    1248
Leu Leu Tyr Arg Ile Gly Ser Trp Val Leu Asp Gly Asp Ala Leu His
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<221> CDS
<222> (1)..(1188)

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  1               5              10              15

gca cta tct gcc cag agc tgc ggg ccg ggc cga gga ccg gtt ggc cgg    96
Ala Leu Ser Ala Gln Ser Cys Gly Pro Gly Arg Gly Pro Val Gly Arg
            20              25              30

cgg cgt tat gtg cgc aag caa ctt gtg cct ctg cta tac aag cag ttt    144
Arg Arg Tyr Val Arg Lys Gln Leu Val Pro Leu Leu Tyr Lys Gln Phe
            35              40              45

gtg ccc agt atg ccc gag cgg acc ctg ggc gcg agt ggg cca gcg gag    192
Val Pro Ser Met Pro Glu Arg Thr Leu Gly Ala Ser Gly Pro Ala Glu
            50              55              60

ggg agg gta aca agg ggg tcg gag cgc ttc cgg gac ctc gta ccc aac    240
Gly Arg Val Thr Arg Gly Ser Glu Arg Phe Arg Asp Leu Val Pro Asn
 65              70              75              80
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tac aac ccc gac ata atc ttc aag gat gag gag aac agc ggc gca gac   288
Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Ser Gly Ala Asp
                85                  90                  95

cgc ctg atg aca gag cgt tgc aaa gag cgg gtg aac gct cta gcc atc   336
Arg Leu Met Thr Glu Arg Cys Lys Glu Arg Val Asn Ala Leu Ala Ile
               100                 105                 110

gcg gtg atg aac atg tgg ccc gga gta cgc cta cgt gtg act gaa ggc   384
Ala Val Met Asn Met Trp Pro Gly Val Arg Leu Arg Val Thr Glu Gly
               115                 120                 125

tgg gac gag gac ggc cac cac gca cag gat tca ctc cac tac gaa ggc   432
Trp Asp Glu Asp Gly His His Ala Gln Asp Ser Leu His Tyr Glu Gly
               130                 135                 140

cgt gcc ttg gac atc acc acg tct gac cgt gac cgt aat aag tat ggt   480
Arg Ala Leu Asp Ile Thr Thr Ser Asp Arg Asp Arg Asn Lys Tyr Gly
145                 150                 155                 160

ttg ttg gcg cgc cta gct gtg gaa gcc gga ttc gac tgg gtc tac tac   528
Leu Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val Tyr Tyr
               165                 170                 175

gag tcc cgc aac cac atc cac gta tcg gtc aaa gct gat aac tca ctg   576
Glu Ser Arg Asn His Ile His Val Ser Val Lys Ala Asp Asn Ser Leu
               180                 185                 190

gcg gtc cga gcc gga ggc tgc ttt ccg gga aat gcc acg gtg cgc ttg   624
Ala Val Arg Ala Gly Gly Cys Phe Pro Gly Asn Ala Thr Val Arg Leu
               195                 200                 205

cgg agc ggc gaa cgg aag ggg ctg agg gaa cta cat cgt ggt gac tgg   672
Arg Ser Gly Glu Arg Lys Gly Leu Arg Glu Leu His Arg Gly Asp Trp
               210                 215                 220

gta ctg gcc gct gat gca gcg ggc cga gtg gta ccc acg cca gtg ctg   720
Val Leu Ala Ala Asp Ala Ala Gly Arg Val Val Pro Thr Pro Val Leu
225                 230                 235                 240

ctc ttc ctg gac cgg gat ctg cag cgc cgc gcc tcg ttc gtg gct gtg   768
Leu Phe Leu Asp Arg Asp Leu Gln Arg Arg Ala Ser Phe Val Ala Val
               245                 250                 255

gag acc gag cgg cct ccg cgc aaa ctg ttg ctc aca ccc tgg cat ctg   816
Glu Thr Glu Arg Pro Pro Arg Lys Leu Leu Leu Thr Pro Trp His Leu
               260                 265                 270

gtg ttc gct gct cgc ggg cca gcg cct gct cca ggt gac ttt gca ccg   864
Val Phe Ala Ala Arg Gly Pro Ala Pro Ala Pro Gly Asp Phe Ala Pro
               275                 280                 285

gtg ttc gcg cgc cgc tta cgt gct ggc gac tcg gtg ctg gct ccc ggc   912
Val Phe Ala Arg Arg Leu Arg Ala Gly Asp Ser Val Leu Ala Pro Gly
               290                 295                 300
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ggg gac gcg ctc cag ccg gcg cgc gta gcc cgc gtg gcg cgc gag gaa    960
Gly Asp Ala Leu Gln Pro Ala Arg Val Ala Arg Val Ala Arg Glu Glu
305                  310              315              320

gcc gtg ggc gtg ttc gca ccg ctc act gcg cac ggg acg ctg ctg gtc   1008
Ala Val Gly Val Phe Ala Pro Leu Thr Ala His Gly Thr Leu Leu Val
                325              330              335

aac gac gtc ctc gcc tcc tgc tac gcg gtt cta gag agt cac cag tgg   1056
Asn Asp Val Leu Ala Ser Cys Tyr Ala Val Leu Glu Ser His Gln Trp
            340              345              350

gcc cac cgc gcc ttc gcc cct ttg cgg ctg ctg cac gcg ctc ggg gct   1104
Ala His Arg Ala Phe Ala Pro Leu Arg Leu Leu His Ala Leu Gly Ala
        355              360              365

ctg ctc cct ggg ggt gca gtc cag ccg act ggc atg cat tgg tac tct   1152
Leu Leu Pro Gly Gly Ala Val Gln Pro Thr Gly Met His Trp Tyr Ser
    370              375              380

cgc ctc ctt tac cgc ttg gcc gag gag tta atg ggc tga                1191
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385              390              395
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<220>
<221> CDS
<222> (1)..(1233)

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  1               5                  10                  15

ctg ctg ctg ctt ctg gtg ccg gcg gcg cgg ggc tgc ggg ccg ggc cgg    96
Leu Leu Leu Leu Leu Val Pro Ala Ala Arg Gly Cys Gly Pro Gly Arg
                20                  25                  30

gtg gtg ggc agc cgc cgg agg ccg cct cgc aag ctc gtg cct ctt gcc   144
Val Val Gly Ser Arg Arg Arg Pro Pro Arg Lys Leu Val Pro Leu Ala
                35                  40                  45

tac aag cag ttc agc ccc aac gtg ccg gag aag acc ctg ggc gcc agc   192
Tyr Lys Gln Phe Ser Pro Asn Val Pro Glu Lys Thr Leu Gly Ala Ser
        50                  55                  60

ggg cgc tac gaa ggc aag atc gcg cgc agc tct gag cgc ttc aaa gag   240
Gly Arg Tyr Glu Gly Lys Ile Ala Arg Ser Ser Glu Arg Phe Lys Glu
65                  70                  75                  80
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ctc acc ccc aac tac aat ccc gac atc atc ttc aag gac gag gag aac    288
Leu Thr Pro Asn Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn
                85                  90                  95

acg ggt gcc gac cgc ctc atg acc cag cgc tgc aag gac cgt ctg aac    336
Thr Gly Ala Asp Arg Leu Met Thr Gln Arg Cys Lys Asp Arg Leu Asn
            100                 105                 110

tca ctg gcc atc tct gtc atg aac cag tgg cct ggt gtg aaa ctg cgg    384
Ser Leu Ala Ile Ser Val Met Asn Gln Trp Pro Gly Val Lys Leu Arg
            115                 120                 125

gtg acc gaa ggc cgg gat gaa gat ggc cat cac tca gag gag tct tta    432
Val Thr Glu Gly Arg Asp Glu Asp Gly His His Ser Glu Glu Ser Leu
        130                 135                 140

cac tat gag ggc cgc gcg gtg gat atc acc acc tca gac cgt gac cga    480
His Tyr Glu Gly Arg Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Arg
145                 150                 155                 160

aat aag tat gga ctg ctg gcg cgc tta gca gtg gag gcc ggc ttc gac    528
Asn Lys Tyr Gly Leu Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp
                165                 170                 175

tgg gtg tat tac gag tcc aag gcc cac gtg cat tgc tct gtc aag tct    576
Trp Val Tyr Tyr Glu Ser Lys Ala His Val His Cys Ser Val Lys Ser
                180                 185                 190

gag cat tcg gcc gct gcc aag aca ggt ggc tgc ttt cct gcc gga gcc    624
Glu His Ser Ala Ala Ala Lys Thr Gly Gly Cys Phe Pro Ala Gly Ala
            195                 200                 205

cag gtg cgc cta gag aac ggg gag cgt gtg gcc ctg tca gct gta aag    672
Gln Val Arg Leu Glu Asn Gly Glu Arg Val Ala Leu Ser Ala Val Lys
        210                 215                 220

cca gga gac cgg gtg ctg gcc atg ggg gag gat ggg acc ccc acc ttc    720
Pro Gly Asp Arg Val Leu Ala Met Gly Glu Asp Gly Thr Pro Thr Phe
225                 230                 235                 240

agt gat gtg ctt att ttc ctg gac cgc gag cca aac cgg ctg aga gct    768
Ser Asp Val Leu Ile Phe Leu Asp Arg Glu Pro Asn Arg Leu Arg Ala
                245                 250                 255

ttc cag gtc atc gag act cag gat cct ccg cgt cgg ctg gcg ctc acg    816
Phe Gln Val Ile Glu Thr Gln Asp Pro Pro Arg Arg Leu Ala Leu Thr
                260                 265                 270

cct gcc cac ctg ctc ttc att gcg gac aat cat aca gaa cca gca gcc    864
Pro Ala His Leu Leu Phe Ile Ala Asp Asn His Thr Glu Pro Ala Ala
            275                 280                 285

cac ttc cgg gcc aca ttt gcc agc cat gtg caa cca ggc caa tat gtg    912
His Phe Arg Ala Thr Phe Ala Ser His Val Gln Pro Gly Gln Tyr Val
            290                 295                 300
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ctg gta tca ggg gta cca ggc ctc cag cct gct cgg gtg gca gct gtc   960
Leu Val Ser Gly Val Pro Gly Leu Gln Pro Ala Arg Val Ala Ala Val
305             310             315             320

tcc acc cac gtg gcc ctt ggg tcc tat gct cct ctc aca agg cat ggg  1008
Ser Thr His Val Ala Leu Gly Ser Tyr Ala Pro Leu Thr Arg His Gly
                325              .          330             335

aca ctt gtg gtg gag gat gtg gtg gcc tcc tgc ttt gca gct gtg gct  1056
Thr Leu Val Val Glu Asp Val Val Ala Ser Cys Phe Ala Ala Val Ala
            340             345             350

gac cac cat ctg gct cag ttg gcc ttc tgg ccc ctg cga ctg ttt ccc  1104
Asp His His Leu Ala Gln Leu Ala Phe Trp Pro Leu Arg Leu Phe Pro
        355             360             365

agt ttg gca tgg ggc agc tgg acc cca agt gag ggt gtt cac tcc tac  1152
Ser Leu Ala Trp Gly Ser Trp Thr Pro Ser Glu Gly Val His Ser Tyr
    370             375             380

cct cag atg ctc tac cgc ctg ggg cgt ctc ttg cta gaa gag agc acc  1200
Pro Gln Met Leu Tyr Arg Leu Gly Arg Leu Leu Leu Glu Glu Ser Thr
385             390             395             400

ttc cat cca ctg ggc atg tct ggg gca gga agc tgaagggact ctaaccactg  1253
Phe His Pro Leu Gly Met Ser Gly Ala Gly Ser
                405             410

ccctcctgga actgctgtgc gtggatcc                                     1281
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<213> murine Shh

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  1             5              10              15

ctg ctg gtg tgc ccc ggg ctg gcc tgt ggg ccc ggc agg ggg ttt gga   96
Leu Leu Val Cys Pro Gly Leu Ala Cys Gly Pro Gly Arg Gly Phe Gly
            20              25              30

aag agg cgg cac ccc aaa aag ctg acc cct tta gcc tac aag cag ttt  144
Lys Arg Arg His Pro Lys Lys Leu Thr Pro Leu Ala Tyr Lys Gln Phe
            35              40              45

att ccc aac gta gcc gag aag acc cta ggg gcc agc ggc aga tat gaa  192
Ile Pro Asn Val Ala Glu Lys Thr Leu Gly Ala Ser Gly Arg Tyr Glu
        50              55              60
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ggg aag atc aca aga aac tcc gaa cga ttt aag gaa ctc acc ccc aat    240
Gly Lys Ile Thr Arg Asn Ser Glu Arg Phe Lys Glu Leu Thr Pro Asn
 65              70              75                  80

tac aac ccc gac atc ata ttt aag gat gag gaa aac acg gga gca gac    288
Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Thr Gly Ala Asp
                 85              90                  95

cgg ctg atg act cag agg tgc aaa gac aag tta aat gcc ttg gcc atc    336
Arg Leu Met Thr Gln Arg Cys Lys Asp Lys Leu Asn Ala Leu Ala Ile
             100             105             110

tct gtg atg aac cag tgg cct gga gtg agg ctg cga gtg acc gag ggc    384
Ser Val Met Asn Gln Trp Pro Gly Val Arg Leu Arg Val Thr Glu Gly
             115             120             125

tgg gat gag gac ggc cat cat tca gag gag tct cta cac tat gag ggt    432
Trp Asp Glu Asp Gly His His Ser Glu Glu Ser Leu His Tyr Glu Gly
             130             135             140

cga gca gtg gac atc acc acg tcc gac cgg gac cgc agc aag tac ggc    480
Arg Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Arg Ser Lys Tyr Gly
145             150             155             160

atg ctg gct cgc ctg gct gtg gaa gca ggt ttc gac tgg gtc tac tat    528
Met Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val Tyr Tyr
             165             170             175

gaa tcc aaa gct cac atc cac tgt tct gtg aaa gca gag aac tcc gtg    576
Glu Ser Lys Ala His Ile His Cys Ser Val Lys Ala Glu Asn Ser Val
             180             185             190

gcg gcc aaa tcc ggc ggc tgt ttc ccg gga tcc gcc acc gtg cac ctg    624
Ala Ala Lys Ser Gly Gly Cys Phe Pro Gly Ser Ala Thr Val His Leu
             195             200             205

gag cag ggc ggc acc aag ctg gtg aag gac tta cgt ccc gga gac cgc    672
Glu Gln Gly Gly Thr Lys Leu Val Lys Asp Leu Arg Pro Gly Asp Arg
             210             215             220

gtg ctg gcg gct gac gac cag ggc cgg ctg ctg tac agc gac ttc ctc    720
Val Leu Ala Ala Asp Asp Gln Gly Arg Leu Leu Tyr Ser Asp Phe Leu
225             230             235             240

acc ttc ctg gac cgc gac gaa ggc gcc aag aag gtc ttc tac gtg atc    768
Thr Phe Leu Asp Arg Asp Glu Gly Ala Lys Lys Val Phe Tyr Val Ile
             245             250             255

gag acg ctg gag ccg cgc gag cgc ctg ctg ctc acc gcc gcg cac ctg    816
Glu Thr Leu Glu Pro Arg Glu Arg Leu Leu Leu Thr Ala Ala His Leu
             260             265             270

ctc ttc gtg gcg ccg cac aac gac tcg ggg ccc acg ccc ggg cca agc    864
Leu Phe Val Ala Pro His Asn Asp Ser Gly Pro Thr Pro Gly Pro Ser
             275             280             285
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gcg ctc ttt gcc agc cgc gtg cgc ccc ggg cag cgc gtg tac gtg gtg    912
Ala Leu Phe Ala Ser Arg Val Arg Pro Gly Gln Arg Val Tyr Val Val
    290             295             300

gct gaa cgc ggc ggg gac cgc cgg ctg ctg ccc gcc gcg gtg cac agc    960
Ala Glu Arg Gly Gly Asp Arg Arg Leu Leu Pro Ala Ala Val His Ser
305             310             315             320

gtg acg ctg cga gag gag gag gcg ggc gcg tac gcg ccg ctc acg gcg   1008
Val Thr Leu Arg Glu Glu Glu Ala Gly Ala Tyr Ala Pro Leu Thr Ala
            325             330             335

cac ggc acc att ctc atc aac cgg gtg ctc gcc tcg tgc tac gct gtc   1056
His Gly Thr Ile Leu Ile Asn Arg Val Leu Ala Ser Cys Tyr Ala Val
            340             345             350

atc gag gag cac agc tgg gca cac cgg gcc ttc gcg cct ttc cgc ctg   1104
Ile Glu Glu His Ser Trp Ala His Arg Ala Phe Ala Pro Phe Arg Leu
            355             360             365

gcg cac gcg ctg ctg gcc gcg ctg gca ccc gcc cgc acg gac ggc ggg   1152
Ala His Ala Leu Leu Ala Ala Leu Ala Pro Ala Arg Thr Asp Gly Gly
    370             375             380

ggc ggg ggc agc atc cct gca gcg caa tct gca acg gaa gcg agg ggc   1200
Gly Gly Gly Ser Ile Pro Ala Ala Gln Ser Ala Thr Glu Ala Arg Gly
385             390             395             400

gcg gag ccg act gcg ggc atc cac tgg tac tcg cag ctg ctc tac cac   1248
Ala Glu Pro Thr Ala Gly Ile His Trp Tyr Ser Gln Leu Leu Tyr His
            405             410             415

att ggc acc tgg ctg ttg gac agc gag acc atg cat ccc ttg gga atg   1296
Ile Gly Thr Trp Leu Leu Asp Ser Glu Thr Met His Pro Leu Gly Met
            420             425             430

gcg gtc aag tcc agc tg                                             1313
Ala Val Lys Ser Ser
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<220>
<221> CDS
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<400> 5
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Met Arg Leu Leu Thr Arg Val Leu Leu Val Ser Leu Leu Thr Leu Ser
1               5               10              15
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ttg gtg gtg tcc gga ctg gcc tgc ggt cct ggc aga ggc tac ggc aga    96
Leu Val Val Ser Gly Leu Ala Cys Gly Pro Gly Arg Gly Tyr Gly Arg
             20                  25                  30

aga aga cat ccg aag aag ctg aca cct ctc gcc tac aag cag ttc ata   144
Arg Arg His Pro Lys Lys Leu Thr Pro Leu Ala Tyr Lys Gln Phe Ile
         35                  40                  45

cct aat gtc gcg gag aag acc tta ggg gcc agc ggc aga tac gag ggc   192
Pro Asn Val Ala Glu Lys Thr Leu Gly Ala Ser Gly Arg Tyr Glu Gly
     50                  55                  60

aag ata acg cgc aat tcg gag aga ttt aaa gaa ctt act cca aat tac   240
Lys Ile Thr Arg Asn Ser Glu Arg Phe Lys Glu Leu Thr Pro Asn Tyr
 65                  70                  75                  80

aat ccc gac att atc ttt aag gat gag gag aac acg gga gcg gac agg   288
Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Thr Gly Ala Asp Arg
                 85                  90                  95

ctc atg aca cag aga tgc aaa gac aag ctg aac tcg ctg gcc atc tct   336
Leu Met Thr Gln Arg Cys Lys Asp Lys Leu Asn Ser Leu Ala Ile Ser
             100                 105                 110

gta atg aac cac tgg cca ggg gtt aag ctg cgt gtg aca gag ggc tgg   384
Val Met Asn His Trp Pro Gly Val Lys Leu Arg Val Thr Glu Gly Trp
         115                 120                 125

gat gag gac ggt cac cat ttt gaa gaa tca ctc cac tac gag gga aga   432
Asp Glu Asp Gly His His Phe Glu Glu Ser Leu His Tyr Glu Gly Arg
         130                 135                 140

gct gtt gat att acc acc tct gac cga gac aag agc aaa tac ggg aca   480
Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Lys Ser Lys Tyr Gly Thr
145                 150                 155                 160

ctg tct cgc cta gct gtg gag gct gga ttt gac tgg gtc tat tac gag   528
Leu Ser Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val Tyr Tyr Glu
                 165                 170                 175

tcc aaa gcc cac att cat tgc tct gtc aaa gca gaa aat tcg gtt gct   576
Ser Lys Ala His Ile His Cys Ser Val Lys Ala Glu Asn Ser Val Ala
             180                 185                 190

gcg aaa tct ggg ggc tgt ttc cca ggt tcg gct ctg gtc tcg ctc cag   624
Ala Lys Ser Gly Gly Cys Phe Pro Gly Ser Ala Leu Val Ser Leu Gln
             195                 200                 205

gac gga gga cag aag gcc gtg aag gac ctg aac ccc gga gac aag gtg   672
Asp Gly Gly Gln Lys Ala Val Lys Asp Leu Asn Pro Gly Asp Lys Val
             210                 215                 220

ctg gcg gca gac agc gcg gga aac ctg gtg ttc agc gac ttc atc atg   720
Leu Ala Ala Asp Ser Ala Gly Asn Leu Val Phe Ser Asp Phe Ile Met
225                 230                 235                 240
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```
ttc aca gac cga gac tcc acg acg cga cgt gtg ttt tac gtc ata gaa    768
Phe Thr Asp Arg Asp Ser Thr Thr Arg Arg Val Phe Tyr Val Ile Glu
            245                 250             255

acg caa gaa ccc gtt gaa aag atc acc ctc acc gcc gct cac ctc ctt    816
Thr Gln Glu Pro Val Glu Lys Ile Thr Leu Thr Ala Ala His Leu Leu
            260                 265             270

ttt gtc ctc gac aac tca acg gaa gat ctc cac acc atg acc gcc gcg    864
Phe Val Leu Asp Asn Ser Thr Glu Asp Leu His Thr Met Thr Ala Ala
            275                 280             285

tat gcc agc agt gtc aga gcc gga caa aag gtg atg gtt gtt gat gat    912
Tyr Ala Ser Ser Val Arg Ala Gly Gln Lys Val Met Val Val Asp Asp
            290                 295             300

agc ggt cag ctt aaa tct gtc atc gtg cag cgg ata tac acg gag gag    960
Ser Gly Gln Leu Lys Ser Val Ile Val Gln Arg Ile Tyr Thr Glu Glu
305                 310                 315                 320

cag cgg ggc tcg ttc gca cca gtg act gca cat ggg acc att gtg gtc   1008
Gln Arg Gly Ser Phe Ala Pro Val Thr Ala His Gly Thr Ile Val Val
                325                 330                 335

gac aga ata ctg gcg tcc tgt tac gcc gta ata gag gac cag ggg ctt   1056
Asp Arg Ile Leu Ala Ser Cys Tyr Ala Val Ile Glu Asp Gln Gly Leu
            340                 345                 350

gcg cat ttg gcc ttc gcg ccc gcc agg ctc tat tat tac gtg tca tca   1104
Ala His Leu Ala Phe Ala Pro Ala Arg Leu Tyr Tyr Tyr Val Ser Ser
            355                 360                 365

ttc ctg tcc ccc aaa act cca gca gtc ggt cca atg cga ctt tac aac   1152
Phe Leu Ser Pro Lys Thr Pro Ala Val Gly Pro Met Arg Leu Tyr Asn
            370                 375                 380

agg agg ggg tcc act ggt act cca ggc tcc tgt cat caa atg gga acg   1200
Arg Arg Gly Ser Thr Gly Thr Pro Gly Ser Cys His Gln Met Gly Thr
385                 390                 395                 400

tgg ctt ttg gac agc aac atg ctt cat cct ttg ggg atg tca gta aac   1248
Trp Leu Leu Asp Ser Asn Met Leu His Pro Leu Gly Met Ser Val Asn
            405                 410                 415

tca agc tg                                                         1256
Ser Ser
```

<210> 6
<211> 1425
<212> DNA
<213> Homo sapien Shh

<220>
<221> CDS
<222> (1)..(1425)

```
<220>
<223> "nnn" encoding "Xaa" at position 1387-1389 may be a, t, c,
      g, other or unknown

<400> 6
atg ctg ctg ctg gcg aga tgt ctg ctg cta gtc ctc gtc tcc tcg ctg    48
Met Leu Leu Leu Ala Arg Cys Leu Leu Leu Val Leu Val Ser Ser Leu
 1               5                  10                  15

ctg gta tgc tcg gga ctg gcg tgc gga ccg ggc agg ggg ttc ggg aag    96
Leu Val Cys Ser Gly Leu Ala Cys Gly Pro Gly Arg Gly Phe Gly Lys
                20                  25                  30

agg agg cac ccc aaa aag ctg acc cct tta gcc tac aag cag ttt atc   144
Arg Arg His Pro Lys Lys Leu Thr Pro Leu Ala Tyr Lys Gln Phe Ile
            35                  40                  45

ccc aat gtg gcc gag aag acc cta ggc gcc agc gga agg tat gaa ggg   192
Pro Asn Val Ala Glu Lys Thr Leu Gly Ala Ser Gly Arg Tyr Glu Gly
        50          .       55                  60

aag atc tcc aga aac tcc gag cga ttt aag gaa ctc acc ccc aat tac   240
Lys Ile Ser Arg Asn Ser Glu Arg Phe Lys Glu Leu Thr Pro Asn Tyr
65                      70                  75                  80

aac ccc gac atc ata ttt aag gat gaa gaa aac acc gga gcg gac agg   288
Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Thr Gly Ala Asp Arg
                85                  90                  95

ctg atg act cag agg tgt aag gac aag ttg aac gct ttg gcc atc tcg   336
Leu Met Thr Gln Arg Cys Lys Asp Lys Leu Asn Ala Leu Ala Ile Ser
            100                 105                 110

gtg atg aac cag tgg cca gga gtg aaa ctg cgg gtg acc gag ggc tgg   384
Val Met Asn Gln Trp Pro Gly Val Lys Leu Arg Val Thr Glu Gly Trp
            115                 120                 125

gac gaa gat ggc cac cac tca gag gag tct ctg cac tac gag ggc cgc   432
Asp Glu Asp Gly His His Ser Glu Glu Ser Leu His Tyr Glu Gly Arg
        130                 135                 140

gca gtg gac atc acc acg tct gac cgc gac cgc agc aag tac ggc atg   480
Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Arg Ser Lys Tyr Gly Met
145                 150                 155                 160

ctg gcc cgc ctg gcg gtg gag gcc ggc ttc gac tgg gtg tac tac gag   528
Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val Tyr Tyr Glu
                165                 170                 175

tcc aag gca cat atc cac tgc tcg gtg aaa gca gag aac tcg gtg gcg   576
Ser Lys Ala His Ile His Cys Ser Val Lys Ala Glu Asn Ser Val Ala
                180                 185                 190

gcc aaa tcg gga ggc tgc ttc ccg ggc tcg gcc acg gtg cac ctg gag   624
Ala Lys Ser Gly Gly Cys Phe Pro Gly Ser Ala Thr Val His Leu Glu
            195                 200                 205
```

```
cag ggc ggc acc aag ctg gtg aag gac ctg agc ccc ggg gac cgc gtg     672
Gln Gly Gly Thr Lys Leu Val Lys Asp Leu Ser Pro Gly Asp Arg Val
    210             215             220

ctg gcg gcg gac gac cag ggc cgg ctg ctc tac agc gac ttc ctc act     720
Leu Ala Ala Asp Asp Gln Gly Arg Leu Leu Tyr Ser Asp Phe Leu Thr
225             230             235             240

ttc ctg gac cgc gac gac ggc gcc aag aag gtc ttc tac gtg atc gag     768
Phe Leu Asp Arg Asp Asp Gly Ala Lys Lys Val Phe Tyr Val Ile Glu
            245             250             255

acg cgg gag ccg cgc gag cgc ctg ctg ctc acc gcc gcg cac ctg ctc     816
Thr Arg Glu Pro Arg Glu Arg Leu Leu Leu Thr Ala Ala His Leu Leu
            260             265             270

ttt gtg gcg ccg cac aac gac tcg gcc acc ggg gag ccc gag gcg tcc     864
Phe Val Ala Pro His Asn Asp Ser Ala Thr Gly Glu Pro Glu Ala Ser
        275             280             285

tcg ggc tcg ggg ccg cct tcc ggg ggc gca ctg ggg cct cgg gcg ctg     912
Ser Gly Ser Gly Pro Pro Ser Gly Gly Ala Leu Gly Pro Arg Ala Leu
    290             295             300

ttc gcc agc cgc gtg cgc ccg ggc cag cgc gtg tac gtg gtg gcc gag     960
Phe Ala Ser Arg Val Arg Pro Gly Gln Arg Val Tyr Val Val Ala Glu
305             310             315             320

cgt gac ggg gac cgc cgg ctc ctg ccc gcc gct gtg cac agc gtg acc     1008
Arg Asp Gly Asp Arg Arg Leu Leu Pro Ala Ala Val His Ser Val Thr
            325             330             335

cta agc gag gag gcc gcg ggc gcc tac gcg ccg ctc acg gcc cag ggc     1056
Leu Ser Glu Glu Ala Ala Gly Ala Tyr Ala Pro Leu Thr Ala Gln Gly
            340             345             350

acc att ctc atc aac cgg gtg ctg gcc tcg tgc tac gcg gtc atc gag     1104
Thr Ile Leu Ile Asn Arg Val Leu Ala Ser Cys Tyr Ala Val Ile Glu
        355             360             365

gag cac agc tgg gcg cac cgg gcc ttc gcg ccc ttc cgc ctg gcg cac     1152
Glu His Ser Trp Ala His Arg Ala Phe Ala Pro Phe Arg Leu Ala His
    370             375             380

gcg ctc ctg gct gca ctg gcg ccc gcg cgc acg gac cgc ggc ggg gac     1200
Ala Leu Leu Ala Ala Leu Ala Pro Ala Arg Thr Asp Arg Gly Gly Asp
385             390             395             400

agc ggc ggc ggg gac cgc ggg ggc ggc ggc ggc aga gta gcc cta acc     1248
Ser Gly Gly Gly Asp Arg Gly Gly Gly Gly Gly Arg Val Ala Leu Thr
            405             410             415

gct cca ggt gct gcc gac gct ccg ggt gcg ggg gcc acc gcg ggc atc     1296
Ala Pro Gly Ala Ala Asp Ala Pro Gly Ala Gly Ala Thr Ala Gly Ile
            420             425             430
```

```
cac tgg tac tcg cag ctg ctc tac caa ata ggc acc tgg ctc ctg gac   1344
His Trp Tyr Ser Gln Leu Leu Tyr Gln Ile Gly Thr Trp Leu Leu Asp
        435                 440                 445

agc gag gcc ctg cac ccg ctg ggc atg gcg gtc aag tcc agc nnn agc   1392
Ser Glu Ala Leu His Pro Leu Gly Met Ala Val Lys Ser Ser Xaa Ser
    450                 455                 460

cgg ggg gcc ggg gga ggg gcg cgg gag ggg gcc                       1425
Arg Gly Ala Gly Gly Gly Ala Arg Glu Gly Ala
465                 470                 475


<210> 7
<211> 1622
<212> DNA
<213> Homo sapien Ihh

<220>
<221> CDS
<222> (51)..(1283)

<400> 7
catcagccca ccaggagacc tcgcccgccg ctcccccggg ctccccggcc atg tct   56
                                                        Met Ser
                                                          1

ccc gcc cgg ctc cgg ccc cga ctg cac ttc tgc ctg gtc ctg ttg ctg  104
Pro Ala Arg Leu Arg Pro Arg Leu His Phe Cys Leu Val Leu Leu Leu
          5                  10                  15

ctg ctg gtg gtg ccc gcg gca tgg ggc tgc ggg ccg ggt cgg gtg gtg  152
Leu Leu Val Val Pro Ala Ala Trp Gly Cys Gly Pro Gly Arg Val Val
        20                  25                  30

ggc agc cgc cgg cga ccg cca cgc aaa ctc gtg ccg ctc gcc tac aag  200
Gly Ser Arg Arg Arg Pro Pro Arg Lys Leu Val Pro Leu Ala Tyr Lys
35                  40                  45                  50

cag ttc agc ccc aat gtg ccc gag aag acc ctg ggc gcc agc gga cgc  248
Gln Phe Ser Pro Asn Val Pro Glu Lys Thr Leu Gly Ala Ser Gly Arg
                55                  60                  65

tat gaa ggc aag atc gct cgc agc tcc gag cgc ttc aag gag ctc acc  296
Tyr Glu Gly Lys Ile Ala Arg Ser Ser Glu Arg Phe Lys Glu Leu Thr
            70                  75                  80

ccc aat tac aat cca gac atc atc ttc aag gac gag gag aac aca ggc  344
Pro Asn Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Thr Gly
            85                  90                  95

gcc gac cgc ctc atg acc cag cgc tgc aag gac cgc ctg aac tcg ctg  392
Ala Asp Arg Leu Met Thr Gln Arg Cys Lys Asp Arg Leu Asn Ser Leu
    100                 105                 110
```

```
gct atc tcg gtg atg aac cag tgg ccc ggt gtg aag ctg cgg gtg acc    440
Ala Ile Ser Val Met Asn Gln Trp Pro Gly Val Lys Leu Arg Val Thr
115             120             125                 130

gag ggc tgg gac gag gac ggc cac cac tca gag gag tcc ctg cat tat    488
Glu Gly Trp Asp Glu Asp Gly His His Ser Glu Glu Ser Leu His Tyr
                135             140                 145

gag ggc cgc gcg gtg gac atc acc aca tca gac cgc gac cgc aat aag    536
Glu Gly Arg Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Arg Asn Lys
            150             155                 160

tat gga ctg ctg gcg cgc ttg gca gtg gag gcc ggc ttt gac tgg gtg    584
Tyr Gly Leu Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val
            165             170                 175

tat tac gag tca aag gcc cac gtg cat tgc tcc gtc aag tcc gag cac    632
Tyr Tyr Glu Ser Lys Ala His Val His Cys Ser Val Lys Ser Glu His
        180             185                 190

tcg gcc gca gcc aag acg ggc ggc tgc ttc cct gcc gga gcc cag gta    680
Ser Ala Ala Ala Lys Thr Gly Gly Cys Phe Pro Ala Gly Ala Gln Val
195             200                 205                 210

cgc ctg gag agt ggg gcg cgt gtg gcc ttg tca gcc gtg agg ccg gga    728
Arg Leu Glu Ser Gly Ala Arg Val Ala Leu Ser Ala Val Arg Pro Gly
                215             220                 225

gac cgt gtg ctg gcc atg ggg gag gat ggg agc ccc acc ttc agc gat    776
Asp Arg Val Leu Ala Met Gly Glu Asp Gly Ser Pro Thr Phe Ser Asp
            230             235                 240

gtg ctc att ttc ctg gac cgc gag ccc cac agg ctg aga gcc ttc cag    824
Val Leu Ile Phe Leu Asp Arg Glu Pro His Arg Leu Arg Ala Phe Gln
            245             250                 255

gtc atc gag act cag gac ccc cca cgc cgc ctg gca ctc aca ccc gct    872
Val Ile Glu Thr Gln Asp Pro Pro Arg Arg Leu Ala Leu Thr Pro Ala
    260             265                 270

cac ctg ctc ttt acg gct gac aat cac acg gag ccg gca gcc cgc ttc    920
His Leu Leu Phe Thr Ala Asp Asn His Thr Glu Pro Ala Ala Arg Phe
275             280                 285                 290

cgg gcc aca ttt gcc agc cac gtg cag cct ggc cag tac gtg ctg gtg    968
Arg Ala Thr Phe Ala Ser His Val Gln Pro Gly Gln Tyr Val Leu Val
            295             300                 305

gct ggg gtg cca ggc ctg cag cct gcc cgc gtg gca gct gtc tct aca   1016
Ala Gly Val Pro Gly Leu Gln Pro Ala Arg Val Ala Ala Val Ser Thr
            310             315                 320

cac gtg gcc ctc ggg gcc tac gcc ccg ctc aca aag cat ggg aca ctg   1064
His Val Ala Leu Gly Ala Tyr Ala Pro Leu Thr Lys His Gly Thr Leu
        325             330                 335
```

```
gtg gtg gag gat gtg gtg gca tcc tgc ttc gcg gcc gtg gct gac cac   1112
Val Val Glu Asp Val Val Ala Ser Cys Phe Ala Ala Val Ala Asp His
    340             345             350

cac ctg gct cag ttg gcc ttc tgg ccc ctg aga ctc ttt cac agc ttg   1160
His Leu Ala Gln Leu Ala Phe Trp Pro Leu Arg Leu Phe His Ser Leu
355             360             365             370

gca tgg ggc agc tgg acc ccg ggg gag ggt gtg cat tgg tac ccc cag   1208
Ala Trp Gly Ser Trp Thr Pro Gly Glu Gly Val His Trp Tyr Pro Gln
            375             380             385

ctc ctc tac cgc ctg ggg cgt ctc ctg cta gaa gag ggc agc ttc cac   1256
Leu Leu Tyr Arg Leu Gly Arg Leu Leu Leu Glu Glu Gly Ser Phe His
            390             395             400

cca ctg ggc atg tcc ggg gca ggg agc tgaaaggact ccaccgctgc         1303
Pro Leu Gly Met Ser Gly Ala Gly Ser
            405             410

cctcctggaa ctgctgtact gggtccagaa gcctctcagc caggagggag ctggccctgg 1363

aagggacctg agctggggga cactggctcc tgccatctcc tctgccatga agatacacca 1423

ttgagacttg actgggcaac accagcgtcc cccacccgcg tcgtggtgta gtcatagagc 1483

tgcaagctga gctggcgagg ggatggttgt tgacccctct ctcctagaga ccttgaggct 1543

ggcacggcga ctcccaactc agcctgctct cactacgagt tttcatactc tgcctccccc 1603

attgggaggg cccattccc                                              1622
```

<210> 8
<211> 1251
<212> DNA
<213> Zebrafish Thh

<220>
<221> CDS
<222> (1)..(1248)

<400> 8
```
atg gac gta agg ctg cat ctg aag caa ttt gct tta ctg tgt ttt atc   48
Met Asp Val Arg Leu His Leu Lys Gln Phe Ala Leu Leu Cys Phe Ile
 1               5               10              15

agc ttg ctt ctg acg cct tgt gga tta gcc tgt ggt cct ggt aga ggt   96
Ser Leu Leu Leu Thr Pro Cys Gly Leu Ala Cys Gly Pro Gly Arg Gly
            20              25              30

tat gga aaa cga aga cac cca aag aaa tta acc ccg ttg gct tac aag   144
Tyr Gly Lys Arg Arg His Pro Lys Lys Leu Thr Pro Leu Ala Tyr Lys
            35              40              45
```

```
caa ttc atc ccc aac gtt gct gag aaa acg ctt gga gcc agc ggc aaa    192
Gln Phe Ile Pro Asn Val Ala Glu Lys Thr Leu Gly Ala Ser Gly Lys
        50              55              60

tac gaa ggc aaa atc aca agg aat tca gag aga ttt aaa gag ctg att    240
Tyr Glu Gly Lys Ile Thr Arg Asn Ser Glu Arg Phe Lys Glu Leu Ile
65              70              75              80

ccg aat tat aat ccc gat atc atc ttt aag gac gag gaa aac aca aac    288
Pro Asn Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Thr Asn
            85              90              95

gct gac agg ctg atg acc aag cgc tgt aag gac aag tta aat tcg ttg    336
Ala Asp Arg Leu Met Thr Lys Arg Cys Lys Asp Lys Leu Asn Ser Leu
            100             105             110

gcc ata tcc gtc atg aac cac tgg ccc ggc gtg aaa ctg cgc gtc act    384
Ala Ile Ser Val Met Asn His Trp Pro Gly Val Lys Leu Arg Val Thr
            115             120             125

gaa ggc tgg gat gag gat ggt cac cat tta gaa gaa tct ttg cac tat    432
Glu Gly Trp Asp Glu Asp Gly His His Leu Glu Glu Ser Leu His Tyr
        130             135             140

gag gga cgg gca gtg gac atc act acc tca gac agg gat aaa agc aag    480
Glu Gly Arg Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Lys Ser Lys
145             150             155             160

tat ggg atg cta tcc agg ctt gca gtg gag gca gga ttc gac tgg gtc    528
Tyr Gly Met Leu Ser Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val
                165             170             175

tat tat gaa tct aaa gcc cac ata cac tgc tct gtc aaa gca gaa aat    576
Tyr Tyr Glu Ser Lys Ala His Ile His Cys Ser Val Lys Ala Glu Asn
            180             185             190

tca gtg gct gct aaa tca gga gga tgt ttt cct ggg tct ggg acg gtg    624
Ser Val Ala Ala Lys Ser Gly Gly Cys Phe Pro Gly Ser Gly Thr Val
            195             200             205

aca ctt ggt gat ggg acg agg aaa ccc atc aaa gat ctt aaa gtg ggc    672
Thr Leu Gly Asp Gly Thr Arg Lys Pro Ile Lys Asp Leu Lys Val Gly
            210             215             220

gac cgg gtt ttg gct gca gac gag aag gga aat gtc tta ata agc gac    720
Asp Arg Val Leu Ala Ala Asp Glu Lys Gly Asn Val Leu Ile Ser Asp
225             230             235             240

ttt att atg ttt ata gac cac gat ccg aca acg aga agg caa ttc atc    768
Phe Ile Met Phe Ile Asp His Asp Pro Thr Thr Arg Arg Gln Phe Ile
                245             250             255

gtc atc gag acg tca gaa cct ttc acc aag ctc acc ctc act gcc gcg    816
Val Ile Glu Thr Ser Glu Pro Phe Thr Lys Leu Thr Leu Thr Ala Ala
                260             265             270
```

```
cac cta gtt ttc gtt gga aac tct tca gca gct tcg ggt ata aca gca    864
His Leu Val Phe Val Gly Asn Ser Ser Ala Ala Ser Gly Ile Thr Ala
        275             280             285

aca ttt gcc agc aac gtg aag cct gga gat aca gtt tta gtg tgg gaa    912
Thr Phe Ala Ser Asn Val Lys Pro Gly Asp Thr Val Leu Val Trp Glu
    290             295             300

gac aca tgc gag agc ctc aag agc gtt aca gtg aaa agg att tac act    960
Asp Thr Cys Glu Ser Leu Lys Ser Val Thr Val Lys Arg Ile Tyr Thr
305             310             315             320

gag gag cac gag ggc tct ttt gcg cca gtc acc gcg cac gga acc ata   1008
Glu Glu His Glu Gly Ser Phe Ala Pro Val Thr Ala His Gly Thr Ile
            325             330             335

ata gtg gat cag gtg ttg gca tcg tgc tac gcg gtc att gag aac cac   1056
Ile Val Asp Gln Val Leu Ala Ser Cys Tyr Ala Val Ile Glu Asn His
            340             345             350

aaa tgg gca cat tgg gct ttt gcg ccg gtc agg ttg tgt cac aag ctg   1104
Lys Trp Ala His Trp Ala Phe Ala Pro Val Arg Leu Cys His Lys Leu
        355             360             365

atg acg tgg ctt ttt ccg gct cgt gaa tca aac gtc aat ttt cag gag   1152
Met Thr Trp Leu Phe Pro Ala Arg Glu Ser Asn Val Asn Phe Gln Glu
370             375             380

gat ggt atc cac tgg tac tca aat atg ctg ttt cac atc ggc tct tgg   1200
Asp Gly Ile His Trp Tyr Ser Asn Met Leu Phe His Ile Gly Ser Trp
385             390             395             400

ctg ctg gac aga gac tct ttc cat cca ctc ggg att tta cac tta agt   1248
Leu Leu Asp Arg Asp Ser Phe His Pro Leu Gly Ile Leu His Leu Ser
            405             410             415

tga                                                               1251


<210> 9
<211> 1416
<212> DNA
<213> Drosophila HH

<220>
<221> CDS
<222> (1)..(1413)

<400> 9
atg gat aac cac agc tca gtg cct tgg gcc agt gcc gcc agt gtc acc     48
Met Asp Asn His Ser Ser Val Pro Trp Ala Ser Ala Ala Ser Val Thr
1               5               10              15

tgt ctc tcc ctg gga tgc caa atg cca cag ttc cag ttc cag ttc cag     96
Cys Leu Ser Leu Gly Cys Gln Met Pro Gln Phe Gln Phe Gln Phe Gln
            20              25              30
```

```
ctc caa atc cgc agc gag ctc cat ctc cgc aag ccc gca aga aga acg    144
Leu Gln Ile Arg Ser Glu Leu His Leu Arg Lys Pro Ala Arg Arg Thr
        35                  40                  45

caa acg atg cgc cac att gcg cat acg cag cgt tgc ctc agc agg ctg    192
Gln Thr Met Arg His Ile Ala His Thr Gln Arg Cys Leu Ser Arg Leu
        50                  55                  60

acc tct ctg gtg gcc ctg ctg ctc atc gtc ttg ccg atg gtc ttt agc    240
Thr Ser Leu Val Ala Leu Leu Leu Ile Val Leu Pro Met Val Phe Ser
65                  70                  75                  80

ccg gct cac agc tgc ggt cct ggc cga gga ttg ggt cgt cat agg gcg    288
Pro Ala His Ser Cys Gly Pro Gly Arg Gly Leu Gly Arg His Arg Ala
                85                  90                  95

cgc aac ctg tat ccg ctg gtc ctc aag cag aca att ccc aat cta tcc    336
Arg Asn Leu Tyr Pro Leu Val Leu Lys Gln Thr Ile Pro Asn Leu Ser
                100                 105                 110

gag tac acg aac agc gcc tcc gga cct ctg gag ggt gtg atc cgt cgg    384
Glu Tyr Thr Asn Ser Ala Ser Gly Pro Leu Glu Gly Val Ile Arg Arg
        115                 120                 125

gat tcg ccc aaa ttc aag gac ctc gtg ccc aac tac aac agg gac atc    432
Asp Ser Pro Lys Phe Lys Asp Leu Val Pro Asn Tyr Asn Arg Asp Ile
        130                 135                 140

ctt ttc cgt gac gag gaa ggc acc gga gcg gat ggc ttg atg agc aag    480
Leu Phe Arg Asp Glu Glu Gly Thr Gly Ala Asp Gly Leu Met Ser Lys
145                 150                 155                 160

cgc tgc aag gag aag cta aac gtg ctg gcc tac tcg gtg atg aac gaa    528
Arg Cys Lys Glu Lys Leu Asn Val Leu Ala Tyr Ser Val Met Asn Glu
                165                 170                 175

tgg ccc ggc atc cgg ctg ctg gtc acc gag agc tgg gac gag gac tac    576
Trp Pro Gly Ile Arg Leu Leu Val Thr Glu Ser Trp Asp Glu Asp Tyr
                180                 185                 190

cat cac ggc cag gag tcg ctc cac tac gag ggc cga gcg gtg acc att    624
His His Gly Gln Glu Ser Leu His Tyr Glu Gly Arg Ala Val Thr Ile
        195                 200                 205

gcc acc tcc gat cgc gac cag tcc aaa tac ggc atg ctc gct cgc ctg    672
Ala Thr Ser Asp Arg Asp Gln Ser Lys Tyr Gly Met Leu Ala Arg Leu
        210                 215                 220

gcc gtc gag gct gga ttc gat tgg gtc tcc tac gtc agc agg cgc cac    720
Ala Val Glu Ala Gly Phe Asp Trp Val Ser Tyr Val Ser Arg Arg His
225                 230                 235                 240

atc tac tgc tcc gtc aag tca gat tcg tcg atc agt tcc cac gtg cac    768
Ile Tyr Cys Ser Val Lys Ser Asp Ser Ser Ile Ser Ser His Val His
                245                 250                 255
```

```
ggc tgc ttc acg ccg gag agc aca gcg ctg ctg gag agt gga gtc cgg    816
Gly Cys Phe Thr Pro Glu Ser Thr Ala Leu Leu Glu Ser Gly Val Arg
            260             265             270

aag ccg ctc ggc gag ctc tct atc gga gat cgt gtt ttg agc atg acc    864
Lys Pro Leu Gly Glu Leu Ser Ile Gly Asp Arg Val Leu Ser Met Thr
            275             280             285

gcc aac gga cag gcc gtc tac agc gaa gtg atc ctc ttc atg gac cgc    912
Ala Asn Gly Gln Ala Val Tyr Ser Glu Val Ile Leu Phe Met Asp Arg
    290             295             300

aac ctc gag cag atg caa aac ttt gtg cag ctg cac acg gac ggt gga    960
Asn Leu Glu Gln Met Gln Asn Phe Val Gln Leu His Thr Asp Gly Gly
305             310             315             320

gca gtg ctc acg gtg acg ccg gct cac ctg gtt agc gtt tgg cag ccg   1008
Ala Val Leu Thr Val Thr Pro Ala His Leu Val Ser Val Trp Gln Pro
            325             330             335

gag agc cag aag ctc acg ttt gtg ttt gcg cat cgc atc gag gag aag   1056
Glu Ser Gln Lys Leu Thr Phe Val Phe Ala His Arg Ile Glu Glu Lys
            340             345             350

aac cag gtg ctc gta cgg gat gtg gag acg ggc gag ctg agg ccc cag   1104
Asn Gln Val Leu Val Arg Asp Val Glu Thr Gly Glu Leu Arg Pro Gln
            355             360             365

cga gtg gtc aag ttg ggc agt gtg cgc agt aag ggc gtg gtc gcg ccg   1152
Arg Val Val Lys Leu Gly Ser Val Arg Ser Lys Gly Val Val Ala Pro
370             375             380

ctg acc cgc gag ggc acc att gtg gtc aac tcg gtg gcc gcc agt tgc   1200
Leu Thr Arg Glu Gly Thr Ile Val Val Asn Ser Val Ala Ala Ser Cys
385             390             395             400

tat gcg gtg atc aac agt cag tcg ctg gcc cac tgg gga ctg gct ccc   1248
Tyr Ala Val Ile Asn Ser Gln Ser Leu Ala His Trp Gly Leu Ala Pro
                405             410             415

atg cgc ctg ctg tcc acg ctg gag gcg tgg ctg ccc gcc aag gag cag   1296
Met Arg Leu Leu Ser Thr Leu Glu Ala Trp Leu Pro Ala Lys Glu Gln
            420             425             430

ttg cac agt tcg ccg aag gtg gtg agc tcg gcg cag cag cag aat ggc   1344
Leu His Ser Ser Pro Lys Val Val Ser Ser Ala Gln Gln Gln Asn Gly
            435             440             445

atc cat tgg tat gcc aat gcg ctc tac aag gtc aag gac tac gtg ctg   1392
Ile His Trp Tyr Ala Asn Ala Leu Tyr Lys Val Lys Asp Tyr Val Leu
    450             455             460

ccg cag agc tgg cgc cac gat tga                                   1416
Pro Gln Ser Trp Arg His Asp
465             470
```

<210> 10
<211> 425
<212> PRT
<213> chicken Shh

<400> 10
Met Val Glu Met Leu Leu Leu Thr Arg Ile Leu Leu Val Gly Phe Ile
1   5   10   15

Cys Ala Leu Leu Val Ser Ser Gly Leu Thr Cys Gly Pro Gly Arg Gly
            20   25   30

Ile Gly Lys Arg Arg His Pro Lys Lys Leu Thr Pro Leu Ala Tyr Lys
            35   40   45

Gln Phe Ile Pro Asn Val Ala Glu Lys Thr Leu Gly Ala Ser Gly Arg
        50   55   60

Tyr Glu Gly Lys Ile Thr Arg Asn Ser Glu Arg Phe Lys Glu Leu Thr
65   70   75   80

Pro Asn Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Thr Gly
            85   90   95

Ala Asp Arg Leu Met Thr Gln Arg Cys Lys Asp Lys Leu Asn Ala Leu
            100   105   110

Ala Ile Ser Val Met Asn Gln Trp Pro Gly Val Lys Leu Arg Val Thr
            115   120   125

Glu Gly Trp Asp Glu Asp Gly His His Ser Glu Glu Ser Leu His Tyr
        130   135   140

Glu Gly Arg Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Arg Ser Lys
145   150   155   160

Tyr Gly Met Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val
            165   170   175

Tyr Tyr Glu Ser Lys Ala His Ile His Cys Ser Val Lys Ala Glu Asn
            180   185   190

Ser Val Ala Ala Lys Ser Gly Gly Cys Phe Pro Gly Ser Ala Thr Val
            195   200   205

His Leu Glu His Gly Gly Thr Lys Leu Val Lys Asp Leu Ser Pro Gly
    210   215   220

Asp Arg Val Leu Ala Ala Asp Ala Asp Gly Arg Leu Leu Tyr Ser Asp
225   230   235   240

Phe Leu Thr Phe Leu Asp Arg Met Asp Ser Ser Arg Lys Leu Phe Tyr
            245   250   255

Val Ile Glu Thr Arg Gln Pro Arg Ala Arg Leu Leu Leu Thr Ala Ala
            260   265   270

```
His Leu Leu Phe Val Ala Pro Gln His Asn Gln Ser Glu Ala Thr Gly
        275             280             285

Ser Thr Ser Gly Gln Ala Leu Phe Ala Ser Asn Val Lys Pro Gly Gln
    290             295             300

Arg Val Tyr Val Leu Gly Glu Gly Gly Gln Gln Leu Leu Pro Ala Ser
305             310             315             320

Val His Ser Val Ser Leu Arg Glu Glu Ala Ser Gly Ala Tyr Ala Pro
                325             330             335

Leu Thr Ala Gln Gly Thr Ile Leu Ile Asn Arg Val Leu Ala Ser Cys
            340             345             350

Tyr Ala Val Ile Glu Glu His Ser Trp Ala His Trp Ala Phe Ala Pro
            355             360             365

Phe Arg Leu Ala Gln Gly Leu Leu Ala Ala Leu Cys Pro Asp Gly Ala
    370             375             380

Ile Pro Thr Ala Ala Thr Thr Thr Thr Gly Ile His Trp Tyr Ser Arg
385             390             395             400

Leu Leu Tyr Arg Ile Gly Ser Trp Val Leu Asp Gly Asp Ala Leu His
            405             410             415

Pro Leu Gly Met Val Ala Pro Ala Ser
            420             425


<210> 11
<211> 396
<212> PRT
<213> murine Dhh

<400> 11
Met Ala Leu Pro Ala Ser Leu Leu Pro Leu Cys Cys Leu Ala Leu Leu
  1           5               10              15

Ala Leu Ser Ala Gln Ser Cys Gly Pro Gly Arg Gly Pro Val Gly Arg
            20              25              30

Arg Arg Tyr Val Arg Lys Gln Leu Val Pro Leu Leu Tyr Lys Gln Phe
            35              40              45

Val Pro Ser Met Pro Glu Arg Thr Leu Gly Ala Ser Gly Pro Ala Glu
    50              55              60

Gly Arg Val Thr Arg Gly Ser Glu Arg Phe Arg Asp Leu Val Pro Asn
65              70              75              80

Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Ser Gly Ala Asp
            85              90              95

Arg Leu Met Thr Glu Arg Cys Lys Glu Arg Val Asn Ala Leu Ala Ile
            100             105             110
```

```
Ala Val Met Asn Met Trp Pro Gly Val Arg Leu Arg Val Thr Glu Gly
        115             120             125

Trp Asp Glu Asp Gly His His Ala Gln Asp Ser Leu His Tyr Glu Gly
    130             135             140

Arg Ala Leu Asp Ile Thr Thr Ser Asp Arg Asp Arg Asn Lys Tyr Gly
145             150             155                 160

Leu Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val Tyr Tyr
            165             170             175

Glu Ser Arg Asn His Ile His Val Ser Val Lys Ala Asp Asn Ser Leu
        180             185             190

Ala Val Arg Ala Gly Gly Cys Phe Pro Gly Asn Ala Thr Val Arg Leu
        195             200             205

Arg Ser Gly Glu Arg Lys Gly Leu Arg Glu Leu His Arg Gly Asp Trp
    210             215             220

Val Leu Ala Ala Asp Ala Ala Gly Arg Val Val Pro Thr Pro Val Leu
225             230             235             240

Leu Phe Leu Asp Arg Asp Leu Gln Arg Arg Ala Ser Phe Val Ala Val
            245             250             255

Glu Thr Glu Arg Pro Pro Arg Lys Leu Leu Leu Thr Pro Trp His Leu
            260             265             270

Val Phe Ala Ala Arg Gly Pro Ala Pro Ala Pro Gly Asp Phe Ala Pro
    275             280             285

Val Phe Ala Arg Arg Leu Arg Ala Gly Asp Ser Val Leu Ala Pro Gly
    290             295             300

Gly Asp Ala Leu Gln Pro Ala Arg Val Ala Arg Val Ala Arg Glu Glu
305             310             315             320

Ala Val Gly Val Phe Ala Pro Leu Thr Ala His Gly Thr Leu Leu Val
            325             330             335

Asn Asp Val Leu Ala Ser Cys Tyr Ala Val Leu Glu Ser His Gln Trp
            340             345             350

Ala His Arg Ala Phe Ala Pro Leu Arg Leu Leu His Ala Leu Gly Ala
        355             360             365

Leu Leu Pro Gly Gly Ala Val Gln Pro Thr Gly Met His Trp Tyr Ser
    370             375             380

Arg Leu Leu Tyr Arg Leu Ala Glu Glu Leu Met Gly
385             390             395
```

<210> 12
<211> 411

<212> PRT
<213> murine Ihh

<400> 12

```
Met Ser Pro Ala Trp Leu Arg Pro Arg Leu Arg Phe Cys Leu Phe Leu
 1               5                  10                  15

Leu Leu Leu Leu Leu Val Pro Ala Ala Arg Gly Cys Gly Pro Gly Arg
            20                  25                  30

Val Val Gly Ser Arg Arg Arg Pro Pro Arg Lys Leu Val Pro Leu Ala
            35                  40                  45

Tyr Lys Gln Phe Ser Pro Asn Val Pro Glu Lys Thr Leu Gly Ala Ser
    50                  55                  60

Gly Arg Tyr Glu Gly Lys Ile Ala Arg Ser Ser Glu Arg Phe Lys Glu
65                  70                  75                  80

Leu Thr Pro Asn Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn
            85                  90                  95

Thr Gly Ala Asp Arg Leu Met Thr Gln Arg Cys Lys Asp Arg Leu Asn
            100             105             110

Ser Leu Ala Ile Ser Val Met Asn Gln Trp Pro Gly Val Lys Leu Arg
    115                 120             125

Val Thr Glu Gly Arg Asp Glu Asp Gly His His Ser Glu Glu Ser Leu
    130                 135             140

His Tyr Glu Gly Arg Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Arg
145                 150             155             160

Asn Lys Tyr Gly Leu Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp
            165                 170             175

Trp Val Tyr Tyr Glu Ser Lys Ala His Val His Cys Ser Val Lys Ser
            180                 185             190

Glu His Ser Ala Ala Ala Lys Thr Gly Gly Cys Phe Pro Ala Gly Ala
    195                 200             205

Gln Val Arg Leu Glu Asn Gly Glu Arg Val Ala Leu Ser Ala Val Lys
    210                 215             220

Pro Gly Asp Arg Val Leu Ala Met Gly Glu Asp Gly Thr Pro Thr Phe
225                 230             235             240

Ser Asp Val Leu Ile Phe Leu Asp Arg Glu Pro Asn Arg Leu Arg Ala
            245                 250             255

Phe Gln Val Ile Glu Thr Gln Asp Pro Pro Arg Arg Leu Ala Leu Thr
            260                 265             270

Pro Ala His Leu Leu Phe Ile Ala Asp Asn His Thr Glu Pro Ala Ala
    275                 280             285
```

```
His Phe Arg Ala Thr Phe Ala Ser His Val Gln Pro Gly Gln Tyr Val
    290             295             300
```

```
Leu Val Ser Gly Val Pro Gly Leu Gln Pro Ala Arg Val Ala Ala Val
305             310             315                 320
```

```
Ser Thr His Val Ala Leu Gly Ser Tyr Ala Pro Leu Thr Arg His Gly
            325             330             335
```

```
Thr Leu Val Val Glu Asp Val Val Ala Ser Cys Phe Ala Ala Val Ala
            340             345             350
```

```
Asp His His Leu Ala Gln Leu Ala Phe Trp Pro Leu Arg Leu Phe Pro
        355             360             365
```

```
Ser Leu Ala Trp Gly Ser Trp Thr Pro Ser Glu Gly Val His Ser Tyr
    370             375             380
```

```
Pro Gln Met Leu Tyr Arg Leu Gly Arg Leu Leu Leu Glu Glu Ser Thr
385             390             395                 400
```

```
Phe His Pro Leu Gly Met Ser Gly Ala Gly Ser
            405             410
```


<210> 13
<211> 437
<212> PRT
<213> murine Shh

<400> 13
```
Met Leu Leu Leu Leu Ala Arg Cys Phe Leu Val Ile Leu Ala Ser Ser
  1             5               10                  15
```

```
Leu Leu Val Cys Pro Gly Leu Ala Cys Gly Pro Gly Arg Gly Phe Gly
            20              25              30
```

```
Lys Arg Arg His Pro Lys Lys Leu Thr Pro Leu Ala Tyr Lys Gln Phe
        35              40              45
```

```
Ile Pro Asn Val Ala Glu Lys Thr Leu Gly Ala Ser Gly Arg Tyr Glu
    50              55              60
```

```
Gly Lys Ile Thr Arg Asn Ser Glu Arg Phe Lys Glu Leu Thr Pro Asn
65              70              75                  80
```

```
Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Thr Gly Ala Asp
            85              90              95
```

```
Arg Leu Met Thr Gln Arg Cys Lys Asp Lys Leu Asn Ala Leu Ala Ile
            100             105             110
```

```
Ser Val Met Asn Gln Trp Pro Gly Val Arg Leu Arg Val Thr Glu Gly
            115             120             125
```

```
Trp Asp Glu Asp Gly His His Ser Glu Glu Ser Leu His Tyr Glu Gly
130             135             140
```

Arg Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Arg Ser Lys Tyr Gly
145   150   155   160

Met Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val Tyr Tyr
            165   170   175

Glu Ser Lys Ala His Ile His Cys Ser Val Lys Ala Glu Asn Ser Val
            180   185   190

Ala Ala Lys Ser Gly Gly Cys Phe Pro Gly Ser Ala Thr Val His Leu
            195   200   205

Glu Gln Gly Gly Thr Lys Leu Val Lys Asp Leu Arg Pro Gly Asp Arg
    210   215   220

Val Leu Ala Ala Asp Asp Gln Gly Arg Leu Leu Tyr Ser Asp Phe Leu
225   230   235   240

Thr Phe Leu Asp Arg Asp Glu Gly Ala Lys Lys Val Phe Tyr Val Ile
            245   250   255

Glu Thr Leu Glu Pro Arg Glu Arg Leu Leu Leu Thr Ala Ala His Leu
            260   265   270

Leu Phe Val Ala Pro His Asn Asp Ser Gly Pro Thr Pro Gly Pro Ser
    275   280   285

Ala Leu Phe Ala Ser Arg Val Arg Pro Gly Gln Arg Val Tyr Val Val
    290   295   300

Ala Glu Arg Gly Gly Asp Arg Arg Leu Leu Pro Ala Ala Val His Ser
305   310   315   320

Val Thr Leu Arg Glu Glu Glu Ala Gly Ala Tyr Ala Pro Leu Thr Ala
            325   330   335

His Gly Thr Ile Leu Ile Asn Arg Val Leu Ala Ser Cys Tyr Ala Val
            340   345   350

Ile Glu Glu His Ser Trp Ala His Arg Ala Phe Ala Pro Phe Arg Leu
            355   360   365

Ala His Ala Leu Leu Ala Ala Leu Ala Pro Ala Arg Thr Asp Gly Gly
    370   375   380

Gly Gly Gly Ser Ile Pro Ala Ala Gln Ser Ala Thr Glu Ala Arg Gly
385   390   395   400

Ala Glu Pro Thr Ala Gly Ile His Trp Tyr Ser Gln Leu Leu Tyr His
            405   410   415

Ile Gly Thr Trp Leu Leu Asp Ser Glu Thr Met His Pro Leu Gly Met
            420   425   430

Ala Val Lys Ser Ser
    435

<210> 14
<211> 418
<212> PRT
<213> zebrafish Shh

<400> 14
Met Arg Leu Leu Thr Arg Val Leu Leu Val Ser Leu Leu Thr Leu Ser
1   5   10   15

Leu Val Val Ser Gly Leu Ala Cys Gly Pro Gly Arg Gly Tyr Gly Arg
            20   25   30

Arg Arg His Pro Lys Lys Leu Thr Pro Leu Ala Tyr Lys Gln Phe Ile
        35   40   45

Pro Asn Val Ala Glu Lys Thr Leu Gly Ala Ser Gly Arg Tyr Glu Gly
    50   55   60

Lys Ile Thr Arg Asn Ser Glu Arg Phe Lys Glu Leu Thr Pro Asn Tyr
65   70   75   80

Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Thr Gly Ala Asp Arg
            85   90   95

Leu Met Thr Gln Arg Cys Lys Asp Lys Leu Asn Ser Leu Ala Ile Ser
        100   105   110

Val Met Asn His Trp Pro Gly Val Lys Leu Arg Val Thr Glu Gly Trp
        115   120   125

Asp Glu Asp Gly His His Phe Glu Glu Ser Leu His Tyr Glu Gly Arg
    130   135   140

Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Lys Ser Lys Tyr Gly Thr
145   150   155   160

Leu Ser Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val Tyr Tyr Glu
            165   170   175

Ser Lys Ala His Ile His Cys Ser Val Lys Ala Glu Asn Ser Val Ala
            180   185   190

Ala Lys Ser Gly Gly Cys Phe Pro Gly Ser Ala Leu Val Ser Leu Gln
        195   200   205

Asp Gly Gly Gln Lys Ala Val Lys Asp Leu Asn Pro Gly Asp Lys Val
    210   215   220

Leu Ala Ala Asp Ser Ala Gly Asn Leu Val Phe Ser Asp Phe Ile Met
225   230   235   240

Phe Thr Asp Arg Asp Ser Thr Thr Arg Arg Val Phe Tyr Val Ile Glu
            245   250   255

Thr Gln Glu Pro Val Glu Lys Ile Thr Leu Thr Ala Ala His Leu Leu
            260   265   270

Phe Val Leu Asp Asn Ser Thr Glu Asp Leu His Thr Met Thr Ala Ala
    275   280   285

Tyr Ala Ser Ser Val Arg Ala Gly Gln Lys Val Met Val Val Asp Asp
    290   295   300

Ser Gly Gln Leu Lys Ser Val Ile Val Gln Arg Ile Tyr Thr Glu Glu
305   310   315   320

Gln Arg Gly Ser Phe Ala Pro Val Thr Ala His Gly Thr Ile Val Val
            325   330   335

Asp Arg Ile Leu Ala Ser Cys Tyr Ala Val Ile Glu Asp Gln Gly Leu
        340   345   350

Ala His Leu Ala Phe Ala Pro Ala Arg Leu Tyr Tyr Tyr Val Ser Ser
      355   360   365

Phe Leu Ser Pro Lys Thr Pro Ala Val Gly Pro Met Arg Leu Tyr Asn
    370   375   380

Arg Arg Gly Ser Thr Gly Thr Pro Gly Ser Cys His Gln Met Gly Thr
385   390   395   400

Trp Leu Leu Asp Ser Asn Met Leu His Pro Leu Gly Met Ser Val Asn
        405   410   415

Ser Ser

<210> 15
<211> 475
<212> PRT
<213> Homo sapien Shh

<220>
<223> Xaa at position 463 is any or unknown amino acid

<400> 15
Met Leu Leu Leu Ala Arg Cys Leu Leu Leu Val Leu Val Ser Ser Leu
  1   5   10   15

Leu Val Cys Ser Gly Leu Ala Cys Gly Pro Gly Arg Gly Phe Gly Lys
        20   25   30

Arg Arg His Pro Lys Lys Leu Thr Pro Leu Ala Tyr Lys Gln Phe Ile
      35   40   45

Pro Asn Val Ala Glu Lys Thr Leu Gly Ala Ser Gly Arg Tyr Glu Gly
    50   55   60

Lys Ile Ser Arg Asn Ser Glu Arg Phe Lys Glu Leu Thr Pro Asn Tyr
65   70   75   80

Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Thr Gly Ala Asp Arg
        85   90   95

```
Leu Met Thr Gln Arg Cys Lys Asp Lys Leu Asn Ala Leu Ala Ile Ser
            100             105             110

Val Met Asn Gln Trp Pro Gly Val Lys Leu Arg Val Thr Glu Gly Trp
            115             120             125

Asp Glu Asp Gly His His Ser Glu Glu Ser Leu His Tyr Glu Gly Arg
    130             135             140

Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Arg Ser Lys Tyr Gly Met
145             150             155             160

Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val Tyr Tyr Glu
            165             170             175

Ser Lys Ala His Ile His Cys Ser Val Lys Ala Glu Asn Ser Val Ala
            180             185             190

Ala Lys Ser Gly Gly Cys Phe Pro Gly Ser Ala Thr Val His Leu Glu
            195             200             205

Gln Gly Gly Thr Lys Leu Val Lys Asp Leu Ser Pro Gly Asp Arg Val
    210             215             220

Leu Ala Ala Asp Asp Gln Gly Arg Leu Leu Tyr Ser Asp Phe Leu Thr
225             230             235             240

Phe Leu Asp Arg Asp Asp Gly Ala Lys Lys Val Phe Tyr Val Ile Glu
            245             250             255

Thr Arg Glu Pro Arg Glu Arg Leu Leu Leu Thr Ala Ala His Leu Leu
            260             265             270

Phe Val Ala Pro His Asn Asp Ser Ala Thr Gly Glu Pro Glu Ala Ser
            275             280             285

Ser Gly Ser Gly Pro Pro Ser Gly Gly Ala Leu Gly Pro Arg Ala Leu
    290                 295             300

Phe Ala Ser Arg Val Arg Pro Gly Gln Arg Val Tyr Val Val Ala Glu
305                 310             315             320

Arg Asp Gly Asp Arg Arg Leu Leu Pro Ala Ala Val His Ser Val Thr
            325             330             335

Leu Ser Glu Glu Ala Ala Gly Ala Tyr Ala Pro Leu Thr Ala Gln Gly
            340             345             350

Thr Ile Leu Ile Asn Arg Val Leu Ala Ser Cys Tyr Ala Val Ile Glu
            355             360             365

Glu His Ser Trp Ala His Arg Ala Phe Ala Pro Phe Arg Leu Ala His
            370             375             380

Ala Leu Leu Ala Ala Leu Ala Pro Ala Arg Thr Asp Arg Gly Gly Asp
385                 390             395             400
```

```
Ser Gly Gly Gly Asp Arg Gly Gly Gly Gly Arg Val Ala Leu Thr
            405             410             415

Ala Pro Gly Ala Ala Asp Ala Pro Gly Ala Gly Ala Thr Ala Gly Ile
            420             425             430

His Trp Tyr Ser Gln Leu Leu Tyr Gln Ile Gly Thr Trp Leu Leu Asp
            435             440             445

Ser Glu Ala Leu His Pro Leu Gly Met Ala Val Lys Ser Ser Xaa Ser
    450             455             460

Arg Gly Ala Gly Gly Gly Ala Arg Glu Gly Ala
465             470             475
```

```
<210> 16
<211> 411
<212> PRT
<213> Homo sapien Ihh

<400> 16
Met Ser Pro Ala Arg Leu Arg Pro Arg Leu His Phe Cys Leu Val Leu
  1           5               10              15

Leu Leu Leu Leu Val Val Pro Ala Ala Trp Gly Cys Gly Pro Gly Arg
            20              25              30

Val Val Gly Ser Arg Arg Arg Pro Pro Arg Lys Leu Val Pro Leu Ala
            35              40              45

Tyr Lys Gln Phe Ser Pro Asn Val Pro Glu Lys Thr Leu Gly Ala Ser
    50              55              60

Gly Arg Tyr Glu Gly Lys Ile Ala Arg Ser Ser Glu Arg Phe Lys Glu
65              70              75              80

Leu Thr Pro Asn Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn
            85              90              95

Thr Gly Ala Asp Arg Leu Met Thr Gln Arg Cys Lys Asp Arg Leu Asn
            100             105             110

Ser Leu Ala Ile Ser Val Met Asn Gln Trp Pro Gly Val Lys Leu Arg
            115             120             125

Val Thr Glu Gly Trp Asp Glu Asp Gly His His Ser Glu Glu Ser Leu
    130             135             140

His Tyr Glu Gly Arg Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Arg
145             150             155             160

Asn Lys Tyr Gly Leu Leu Ala Arg Leu Ala Val Glu Ala Gly Phe Asp
            165             170             175

Trp Val Tyr Tyr Glu Ser Lys Ala His Val His Cys Ser Val Lys Ser
            180             185             190
```

Glu His Ser Ala Ala Ala Lys Thr Gly Gly Cys Phe Pro Ala Gly Ala
     195   200   205

Gln Val Arg Leu Glu Ser Gly Ala Arg Val Ala Leu Ser Ala Val Arg
     210   215   220

Pro Gly Asp Arg Val Leu Ala Met Gly Glu Asp Gly Ser Pro Thr Phe
225   230   235   240

Ser Asp Val Leu Ile Phe Leu Asp Arg Glu Pro His Arg Leu Arg Ala
           245   250   255

Phe Gln Val Ile Glu Thr Gln Asp Pro Pro Arg Arg Leu Ala Leu Thr
           260   265   270

Pro Ala His Leu Leu Phe Thr Ala Asp Asn His Thr Glu Pro Ala Ala
          275   280   285

Arg Phe Arg Ala Thr Phe Ala Ser His Val Gln Pro Gly Gln Tyr Val
     290   295   300

Leu Val Ala Gly Val Pro Gly Leu Gln Pro Ala Arg Val Ala Ala Val
305   310   315   320

Ser Thr His Val Ala Leu Gly Ala Tyr Ala Pro Leu Thr Lys His Gly
          325   330   335

Thr Leu Val Val Glu Asp Val Val Ala Ser Cys Phe Ala Ala Val Ala
          340   345   350

Asp His His Leu Ala Gln Leu Ala Phe Trp Pro Leu Arg Leu Phe His
          355   360   365

Ser Leu Ala Trp Gly Ser Trp Thr Pro Gly Glu Gly Val His Trp Tyr
     370   375   380

Pro Gln Leu Leu Tyr Arg Leu Gly Arg Leu Leu Leu Glu Glu Gly Ser
385   390   395   400

Phe His Pro Leu Gly Met Ser Gly Ala Gly Ser
          405   410

<210> 17
<211> 416
<212> PRT
<213> Zebrafish Thh

<400> 17
Met Asp Val Arg Leu His Leu Lys Gln Phe Ala Leu Leu Cys Phe Ile
  1   5   10   15

Ser Leu Leu Leu Thr Pro Cys Gly Leu Ala Cys Gly Pro Gly Arg Gly
          20   25   30

Tyr Gly Lys Arg Arg His Pro Lys Lys Leu Thr Pro Leu Ala Tyr Lys
          35   40   45

```
Gln Phe Ile Pro Asn Val Ala Glu Lys Thr Leu Gly Ala Ser Gly Lys
    50              55              60

Tyr Glu Gly Lys Ile Thr Arg Asn Ser Glu Arg Phe Lys Glu Leu Ile
65              70              75                      80

Pro Asn Tyr Asn Pro Asp Ile Ile Phe Lys Asp Glu Glu Asn Thr Asn
            85              90                      95

Ala Asp Arg Leu Met Thr Lys Arg Cys Lys Asp Lys Leu Asn Ser Leu
            100             105             110

Ala Ile Ser Val Met Asn His Trp Pro Gly Val Lys Leu Arg Val Thr
            115             120             125

Glu Gly Trp Asp Glu Asp Gly His His Leu Glu Glu Ser Leu His Tyr
    130             135             140

Glu Gly Arg Ala Val Asp Ile Thr Thr Ser Asp Arg Asp Lys Ser Lys
145             150             155             160

Tyr Gly Met Leu Ser Arg Leu Ala Val Glu Ala Gly Phe Asp Trp Val
            165             170             175

Tyr Tyr Glu Ser Lys Ala His Ile His Cys Ser Val Lys Ala Glu Asn
            180             185             190

Ser Val Ala Ala Lys Ser Gly Gly Cys Phe Pro Gly Ser Gly Thr Val
            195             200             205

Thr Leu Gly Asp Gly Thr Arg Lys Pro Ile Lys Asp Leu Lys Val Gly
    210             215             220

Asp Arg Val Leu Ala Ala Asp Glu Lys Gly Asn Val Leu Ile Ser Asp
225             230             235             240

Phe Ile Met Phe Ile Asp His Asp Pro Thr Thr Arg Arg Gln Phe Ile
            245             250             255

Val Ile Glu Thr Ser Glu Pro Phe Thr Lys Leu Thr Leu Thr Ala Ala
            260             265             270

His Leu Val Phe Val Gly Asn Ser Ser Ala Ala Ser Gly Ile Thr Ala
    275             280             285

Thr Phe Ala Ser Asn Val Lys Pro Gly Asp Thr Val Leu Val Trp Glu
    290             295             300

Asp Thr Cys Glu Ser Leu Lys Ser Val Thr Val Lys Arg Ile Tyr Thr
305             310             315             320

Glu Glu His Glu Gly Ser Phe Ala Pro Val Thr Ala His Gly Thr Ile
            325             330             335

Ile Val Asp Gln Val Leu Ala Ser Cys Tyr Ala Val Ile Glu Asn His
            340             345             350
```

```
Lys Trp Ala His Trp Ala Phe Ala Pro Val Arg Leu Cys His Lys Leu
        355             360             365
```

```
Met Thr Trp Leu Phe Pro Ala Arg Glu Ser Asn Val Asn Phe Gln Glu
    370             375             380
```

```
Asp Gly Ile His Trp Tyr Ser Asn Met Leu Phe His Ile Gly Ser Trp
385             390             395                 400
```

```
Leu Leu Asp Arg Asp Ser Phe His Pro Leu Gly Ile Leu His Leu Ser
                405             410             415
```

```
<210> 18
<211> 471
<212> PRT
<213> Drosophila HH

<400> 18
Met Asp Asn His Ser Ser Val Pro Trp Ala Ser Ala Ala Ser Val Thr
  1             5               10              15
```

```
Cys Leu Ser Leu Gly Cys Gln Met Pro Gln Phe Gln Phe Gln Phe Gln
              20              25              30
```

```
Leu Gln Ile Arg Ser Glu Leu His Leu Arg Lys Pro Ala Arg Arg Thr
          35              40              45
```

```
Gln Thr Met Arg His Ile Ala His Thr Gln Arg Cys Leu Ser Arg Leu
      50              55              60
```

```
Thr Ser Leu Val Ala Leu Leu Leu Ile Val Leu Pro Met Val Phe Ser
65              70              75              80
```

```
Pro Ala His Ser Cys Gly Pro Gly Arg Gly Leu Gly Arg His Arg Ala
              85              90              95
```

```
Arg Asn Leu Tyr Pro Leu Val Leu Lys Gln Thr Ile Pro Asn Leu Ser
          100             105             110
```

```
Glu Tyr Thr Asn Ser Ala Ser Gly Pro Leu Glu Gly Val Ile Arg Arg
          115             120             125
```

```
Asp Ser Pro Lys Phe Lys Asp Leu Val Pro Asn Tyr Asn Arg Asp Ile
      130             135             140
```

```
Leu Phe Arg Asp Glu Glu Gly Thr Gly Ala Asp Gly Leu Met Ser Lys
145             150             155             160
```

```
Arg Cys Lys Glu Lys Leu Asn Val Leu Ala Tyr Ser Val Met Asn Glu
              165             170             175
```

```
Trp Pro Gly Ile Arg Leu Leu Val Thr Glu Ser Trp Asp Glu Asp Tyr
              180             185             190
```

```
His His Gly Gln Glu Ser Leu His Tyr Glu Gly Arg Ala Val Thr Ile
      195             200             205
```

```
Ala Thr Ser Asp Arg Asp Gln Ser Lys Tyr Gly Met Leu Ala Arg Leu
    210             215         220
```

```
Ala Val Glu Ala Gly Phe Asp Trp Val Ser Tyr Val Ser Arg Arg His
225             230             235                     240
```

```
Ile Tyr Cys Ser Val Lys Ser Asp Ser Ser Ile Ser Ser His Val His
            245             250             255
```

```
Gly Cys Phe Thr Pro Glu Ser Thr Ala Leu Leu Glu Ser Gly Val Arg
            260             265             270
```

```
Lys Pro Leu Gly Glu Leu Ser Ile Gly Asp Arg Val Leu Ser Met Thr
        275             280             285
```

```
Ala Asn Gly Gln Ala Val Tyr Ser Glu Val Ile Leu Phe Met Asp Arg
    290             295             300
```

```
Asn Leu Glu Gln Met Gln Asn Phe Val Gln Leu His Thr Asp Gly Gly
305             310             315             320
```

```
Ala Val Leu Thr Val Thr Pro Ala His Leu Val Ser Val Trp Gln Pro
            325             330             335
```

```
Glu Ser Gln Lys Leu Thr Phe Val Phe Ala His Arg Ile Glu Glu Lys
            340             345             350
```

```
Asn Gln Val Leu Val Arg Asp Val Glu Thr Gly Glu Leu Arg Pro Gln
        355             360             365
```

```
Arg Val Val Lys Leu Gly Ser Val Arg Ser Lys Gly Val Val Ala Pro
    370             375             380
```

```
Leu Thr Arg Glu Gly Thr Ile Val Val Asn Ser Val Ala Ala Ser Cys
385             390             395             400
```

```
Tyr Ala Val Ile Asn Ser Gln Ser Leu Ala His Trp Gly Leu Ala Pro
            405             410             415
```

```
Met Arg Leu Leu Ser Thr Leu Glu Ala Trp Leu Pro Ala Lys Glu Gln
        420             425             430
```

```
Leu His Ser Ser Pro Lys Val Val Ser Ser Ala Gln Gln Gln Asn Gly
        435             440             445
```

```
Ile His Trp Tyr Ala Asn Ala Leu Tyr Lys Val Lys Asp Tyr Val Leu
    450             455             460
```

```
Pro Gln Ser Trp Arg His Asp
465             470
```

<210> 19
<211> 221
<212> PRT
<213> Artificial Sequence

```
<220>
<223> Description of Artificial Sequence: degenerate
      polypeptide sequence

<220>
<222> 7
<223> Gly, Ala, Val, Leu, Ile, Phe, Tyr or Trp

<220>
<222> 9
<223> Arg, His or Lys

<220>
<222> 44
<223> Gly, Ala, Val, Leu, Ile, Ser or Thr

<220>
<222> 85
<223> Gly, Ala, Val, Leu, Ile, Ser or Thr

<220>
<222> 93
<223> Lys, Arg, His, Asn or Gln

<220>
<222> 98
<223> Lys, Arg or His

<220>
<222> 112
<223> Ser, Thr, Tyr, Trp or Phe

<220>
<222> 132
<223> Lys, Arg or His

<220>
<222> 137
<223> Met, Cys, Ser or Thr

<220>
<222> 139
<223> Gly, Ala, Val, Leu, Ile, Ser or Thr

<220>
<222> 181
<223> Leu, Val, Met, Thr or Ser

<220>
<222> 183
<223> His, Phe, Tyr, Ser, Thr, Met or Cys

<220>
<222> 185
<223> Gln, Asn, Glu, or Asp

<220>
```

<222> 186
<223> His, Phe, Tyr, Thr, Gln, Asn, Glu or Asp

<220>
<222> 189
<223> Gln, Asn, Glu, Asp, Thr, Ser, Met or Cys

<220>
<222> 191
<223> Ala, Gly, Cys, Leu, Val or Met

<220>
<222> 196
<223> Arg, Lys, Met, Ile, Asn, Asp, Glu, Gln, Ser, Thr or Cys

<220>
<222> 200
<223> Arg, Lys, Met or Ile

<220>
<222> 206
<223> Ala, Gly, Cys, Asp, Glu, Gln, Asn, Ser, Thr or Met

<220>
<222> 207
<223> Ala, Gly, Cys, Asp, Asn, Glu or Gln

<220>
<222> 209
<223> Arg, Lys, Met, Ile, Asn, Asp, Glu or Gln

<220>
<222> 211
<223> Leu, Val, Met or Ile

<220>
<222> 212
<223> Phe, Tyr, Thr, His or Trp

<220>
<222> 216
<223> Ile, Val, Leu or Met

<220>
<222> 217
<223> Met, Cys, Ile, Leu, Val, Thr or Ser

<220>
<222> 219
<223> Leu, Val, Met, Thr or Ser

<220>
<223> each Xaa may also be any amino acid.

<400> 19
Cys Gly Pro Gly Arg Gly Xaa Gly Xaa Arg Arg His Pro Lys Lys Leu
 1   5   10   15

```
Thr Pro Leu Ala Tyr Lys Gln Phe Ile Pro Asn Val Ala Glu Lys Thr
            20                  25                  30

Leu Gly Ala Ser Gly Arg Tyr Glu Gly Lys Ile Xaa Arg Asn Ser Glu
            35                  40                  45

Arg Phe Lys Glu Leu Thr Pro Asn Tyr Asn Pro Asp Ile Ile Phe Lys
    50                  55                  60

Asp Glu Glu Asn Thr Gly Ala Asp Arg Leu Met Thr Gln Arg Cys Lys
65                  70                  75                  80

Asp Lys Leu Asn Xaa Leu Ala Ile Ser Val Met Asn Xaa Trp Pro Gly
            85                  90                  95

Val Xaa Leu Arg Val Thr Glu Gly Trp Asp Glu Asp Gly His His Xaa
           ·100                 105                 110

Glu Glu Ser Leu His Tyr Glu Gly Arg Ala Val Asp Ile Thr Thr Ser
            115                 120                 125

Asp Arg Asp Xaa Ser Lys Tyr Gly Xaa Leu Xaa Arg Leu Ala Val Glu
    130                 135                 140

Ala Gly Phe Asp Trp Val Tyr Tyr Glu Ser Lys Ala His Ile His Cys
145                 150                 155                 160

Ser Val Lys Ala Glu Asn Ser Val Ala Ala Lys Ser Gly Gly Cys Phe
            165                 170                 175

Pro Gly Ser Ala Xaa Val Xaa Leu Xaa Xaa Gly Gly Xaa Lys Xaa Val
            180                 185                 190

Lys Asp Leu Xaa Pro Gly Asp Xaa Val Leu Ala Ala Asp Xaa Xaa Gly
    195                 200                 205

Xaa Leu Xaa Xaa Ser Asp Phe Xaa Xaa Phe ·Xaa Asp Arg
    210                 215                 220
```

<210> 20
<211> 167
<212> PRT
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: degenerate
     polypeptide sequence

<220>
<222> 7
<223> Gly, Ala, Val, Leu, Ile, Pro, Phe or Tyr

<220>
<222> 8
<223> Gly, Ala, Val, Leu or Ile

<220>
<222> 9
<223> Gly, Ala, Val, Leu, Ile, Lys, His or Arg

<220>
<222> 12
<223> Lys, Arg or His

<220>
<222> 13
<223> Phe, Trp, Tyr or an amino acid gap

<220>
<222> 14
<223> Gly, Ala, Val, Leu, Ile or an amino acid gap

<220>
<222> 17
<223> Asn, Gln, His, Arg or Lys

<220>
<222> 19
<223> Gly, Ala, Val, Leu, Ile, Ser or Thr

<220>
<222> 22
<223> Gly, Ala, Val, Leu, Ile, Ser or Thr

<220>
<222> 27
<223> Gly, Ala, Val, Leu, Ile, Ser or Thr

<220>
<222> 29
<223> Ser, Thr, Gln or Asn

<220>
<222> 30
<223> Met, Cys, Gly, Ala, Val, Leu, Ile, Ser or Thr

<220>
<222> 31
<223> Gly, Ala, Val, Leu, Ile or Pro

<220>
<222> 33
<223> Arg, His or Lys

<220>
<222> 40
<223> Gly, Ala, Val, Leu, Ile, Pro, Arg, His or Lys

<220>
<222> 41
<223> Gly, Ala, Val, Leu, Ile, Phe or Tyr

<220>
<222> 44

<223> Arg, His or Lys

<220>
<222> 45
<223> Gly, Ala, Val, Leu, Ile, Ser or Thr

<220>
<222> 46
<223> Thr or Ser

<220>
<222> 48
<223> Gly, Ala, Val, Leu, Ile, Asn or Gln

<220>
<222> 53
<223> Arg, His or Lys

<220>
<222> 54
<223> Asp or Glu

<220>
<222> 71
<223> Ser or Thr

<220>
<222> 79
<223> Glu, Asp, Gln or Asn

<220>
<222> 83
<223> Glu or Asp

<220>
<222> 84
<223> Arg, His or Lys

<220>
<222> 85
<223> Gly, Ala, Val, Leu or Ile

<220>
<222> 87
<223> Gly, Ala, Val, Leu, Ile, Thr or Ser

<220>
<222> 95
<223> Met, Cys, Gln, Asn, Arg, Lys or His

<220>
<222> 100
<223> Arg, His or Lys

<220>
<222> 107
<223> Trp, Phe, Tyr, Arg, His or Lys

<220>
<222> 114
<223> Gly, Ala, Val, Leu, Ile, Ser, Thr, Tyr or Phe

<220>
<222> 115
<223> Gln, Asn, Asp or Glu

<220>
<222> 116
<223> Asp or Glu

<220>
<222> 125
<223> Gly, Ala, Val, Leu, or Ile

<220>
<222> 134
<223> Arg, His or Lys

<220>
<222> 135
<223> Asn, Gln, Thr or Ser

<220>
<222> 139
<223> Gly, Ala, Val, Leu, Ile, Ser, Thr, Met or Cys

<220>
<222> 141
<223> Gly, Ala, Val, Leu, Ile, Thr or Ser

<220>
<222> 157
<223> Arg, His or Lys

<220>
<222> 158
<223> Asn, Gln, Gly, Ala, Val, Leu or Ile

<220>
<222> 160
<223> Gly, Ala, Val, Leu or Ile

<220>
<222> 162
<223> Gly, Ala, Val, Leu, Ile, Ser, Thr or Cys

<220>
<222> 166
<223> Gly, Ala, Val, Leu, Ile, Thr or Ser

<220>
<222> 167
<223> Asp or Glu

<400> 20
```
Cys Gly Pro Gly Arg Gly Xaa Xaa Xaa Arg Arg Xaa Xaa Xaa Pro Lys
 1               5                  10                  15

Xaa Leu Xaa Pro Leu Xaa Tyr Lys Gln Phe Xaa Pro Xaa Xaa Xaa Glu
            20                  25                  30

Xaa Thr Leu Gly Ala Ser Gly Xaa Xaa Glu Gly Xaa Xaa Xaa Arg Xaa
            35                  40                  45

Ser Glu Arg Phe Xaa Xaa Leu Thr Pro Asn Tyr Asn Pro Asp Ile Ile
    50                  55                  60

Phe Lys Asp Glu Glu Asn Xaa Gly Ala Asp Arg Leu Met Thr Xaa Arg
 65                  70                  75                  80

Cys Lys Xaa Xaa Xaa Asn Xaa Leu Ala Ile Ser Val Met Asn Xaa Trp
            85                  90                  95

Pro Gly Val Xaa Leu Arg Val Thr Glu Gly Xaa Asp Glu Asp Gly His
            100                 105                 110

His Xaa Xaa Xaa Ser Leu His Tyr Glu Gly Arg Ala Xaa Asp Ile Thr
        115                 120                 125

Thr Ser Asp Arg Asp Xaa Xaa Lys Tyr Gly Xaa Leu Xaa Arg Leu Ala
    130                 135                 140

Val Glu Ala Gly Phe Asp Trp Val Tyr Tyr Glu Ser Xaa Xaa His Xaa
145                 150                 155                 160

His Xaa Ser Val Lys Xaa Xaa
            165
```

<210> 21
<211> 74
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: primer

<400> 21
```
gcgcgcttcg aagcgaggca gccagcgagg gagagagcga gcgggcgagc cggagcgagg 60

aaatcgatgc gcgc                                                  74
```

<210> 22
<211> 74
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: primer

<400> 22
gcgcgcagat ctgggaaagc gcaagagaga gcgcacacgc acacacccgc cgcgcgcact 60

cgggatccgc gcgc   74

<210> 23
<211> 996
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: gene
      activation construct

<400> 23
cgaagcgagg cagccagcga gggagagagc gagcgggcga gccggagcga ggaaatcgaa 60

ggttcgaatc cttcccccac caccatcact ttcaaaagtc cgaaagaatc tgctccctgc 120

ttgtgtgttg gaggtcgctg agtagtgcgc gagtaaaatt taagctacaa caaggcaagg 180

cttgaccgac aattgcatga agaatctgct tagggttagg cgttttgcgc tgcttcgcga 240

tgtacgggcc agatatacgc gttgacattg attattgact agttattaat agtaatcaat 300

tacggggtca ttagttcata gcccatatat ggagttccgc gttacataac ttacggtaaa 360

tggcccgcct ggctgaccgc ccaacgaccc ccgcccattg acgtcaataa tgacgtatgt 420

tcccatagta acgccaatag ggactttcca ttgacgtcaa tgggtggact atttacggta 480

aactgcccac ttggcagtac atcaagtgta tcatatgcca agtacgcccc ctattgacgt 540

caatgacggt aaatggcccg cctggcatta tgcccagtac atgaccttat gggactttcc 600

tacttggcag tacatctacg tattagtcat cgctattacc atggtgatgc ggttttggca 660

gtacatcaat gggcgtggat agcggtttga ctcacgggga tttccaagtc tccaccccat 720

tgacgtcaat gggagtttgt tttggcacca aaatcaacgg gactttccaa aatgtcgtaa 780

caactccgcc ccattgacgc aaatgggcgg taggcgtgta cggtgggagg tctatataag 840

cagagctctc tggctaacta gagaacccac tgcttactgg cttatcgaaa ttaatacgac 900

tcactatagg gagacccaag cttggtaccg agctcggatc gatctgggaa agcgcaagag 960

agagcgcaca cgcacacacc cgccgcgcgc actcgg   996

<210> 24
<211> 26
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: antisense
      construct

<400> 24
gtcctggcgc cgccgccgcc gtcgcc   26

<210> 25
<211> 26
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: antisense
      construct

<400> 25
ttccgatgac cggcctttcg cggtga   26

<210> 26
<211> 26
<212> DNA
<213> Artificial Sequence

<220>
<223> Description of Artificial Sequence: antisense
      construct

<400> 26
gtgcacggaa aggtgcaggc cacact   26